**9.5**

**Series**

**Summation Notation**

In **summation notation,** the sum of the terms of the sequence { *a1, a2, a3, … a*n}  is denoted:



Which is read “the sum of *a*k from k = 1 to n.”

The symbol **Σ** is simply an instruction to sum, or add up, the terms. The integer *k* is called the index of the sum, it tells you where to start the sum and where to end it. The expression

 is the instruction to add the terms *a*k of the sequence {*a*n} from k = 1 through k = n.

Add all the numbers from 1 to 100.

(Story of Gauss)

1 + 2 + 3 + 4 + 5 + … + 99 + 100

100 + 99 + 98 + … + 2 + 1

101 X 100 = 10,100

10,100/2 = 5,050

**Sum of n terms of an Arithmetic Sequence**

Let { *a*n} be an arithmetic sequence with first term *a1* and common difference d. The sum Sn of the first n terms of { *a*n} is:







See example 1 pg. 744

**Sum of a Finite Geometric Sequence:**

Let { *a*n} be a finite geometric sequence with common ration r  1. Then the sum of the terms of the sequence is:





See Example 2 pg. 745

**Infinite Series:**

An infinite series is an expression of the form



In some cases the sequence of **partial sums** approaches a finite limit S:



In this case we say that the series **converges** to S, and it makes sense to define S as the **sum of the infinite series**.



If the limit of a partial sum does not exist, then the series **diverges** and has not sum.

See Example 3 pg. 747

**Sum of an Infinite Geometric Series:**

The geometric series  converges if and only if . If it does converge, the sum is .

See Example 4 pg. 748

